



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

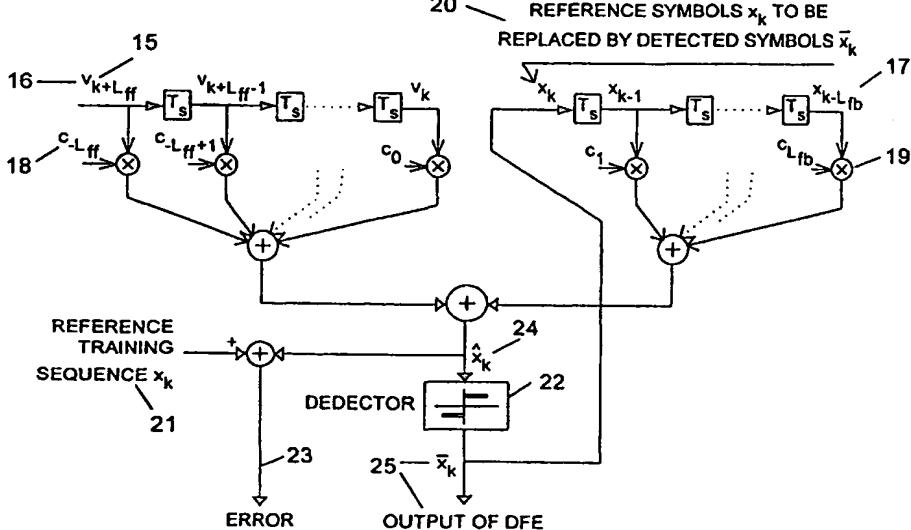
(51) International Patent Classification ⁷ :	A1	(11) International Publication Number:	WO 00/59168
H04L 25/03, 7/04		(43) International Publication Date:	5 October 2000 (05.10.00)
(21) International Application Number:		PCT/GB00/01214	
(22) International Filing Date:		30 March 2000 (30.03.00)	
(30) Priority Data:		30 March 1999 (30.03.99) GB <i>30 Sep 01 / 30 m/s</i>	
(71) Applicant (for all designated States except US): UNIVERSITY OF BRISTOL [GB/GB]; Senate House, Tyndall Avenue, Bristol BS8 1TR (GB).			
(72) Inventors; and			
(75) Inventors/Applicants (for US only): BULL, David, Roger [GB/GB]; Netherways, Netherhope Lane, Tidenham, Nr. Chepstow, Monmouthshire NP16 7JE (GB). NIX, Andrew, Robert [GB/GB]; 7 Bellview, Clifton, Bristol BS8 1DA (GB). KAYA, Ismail [TR/TR]; Karadeniz Technical University, Dept. of Electrical & Electronics Engineering, 61080 Trabzon (TR).			
(74) Agents: VIGARS, Christopher, Ian et al.; Haseltine Lake & Co., Imperial House, 15-19 Kingsway, London WC2B 6UD (GB).			
(54) Title: ADAPTIVE FILTER EQUALISATION TECHNIQUES			

(81) Designated States: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.



(57) Abstract

Multipath communications channels can result in intersymbol interference that requires the use of equalisation techniques to be removed. A method of estimating coefficients of an equaliser filter which receives an input channel signal, includes initialising preselected coefficients of the equaliser filter in accordance with a calculated channel matched filter model, and estimating the coefficients of the filter using an estimation technique and a known input channel signal to the equaliser. Initialising the coefficients in this way enables the training period of the filter to be reduced.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference HL57809/001/CIV	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/GB00/01214	International filing date (day/month/year) 30/03/2000	Priority date (day/month/year) 30/03/1999
International Patent Classification (IPC) or national classification and IPC H04L25/03		
<p>Applicant UNIVERSITY OF BRISTOL</p> <p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p> <p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input checked="" type="checkbox"/> Certain defects in the international application VIII <input checked="" type="checkbox"/> Certain observations on the international application 		

Date of submission of the demand 25/10/2000	Date of completion of this report 28.06.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Cretaine, P Telephone No. +49 89 2399 8828



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB00/01214

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-16 as originally filed

Claims, No.:

1-8 as originally filed

Drawings, sheets:

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:
- the claims, Nos.:

INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

International application No. PCT/GB00/01214

the drawings, sheets:

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N) Yes: Claims 2-8
 No: Claims 1

Inventive step (IS) Yes: Claims
 No: Claims 1-8

Industrial applicability (IA) Yes: Claims 1-8
 No: Claims

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/01214

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:

D1 = WO-A-91 17607

D2 = KAYA I. et al.: "Exploiting multipath activity using low complexity equalisation techniques for high speed wireless LANs", VTC '98, 48TH IEEE VEHICULAR TECHNOLOGY CONFERENCE, 18-21 MAY 1998, pages 1593-1597 vol.2, New York, NY, USA.

D3 = EP-A-0 880 253

2. The subject-matter of claim 1 is not new, Article 33(2) PCT. In this respect, D1 discloses, according to all the features of claim 1, a method of estimating coefficients of an equaliser filter which receives an input channel signal (page 2, line 25 to page 3, line 5), the method including initialising preselected coefficients of the equaliser filter in accordance with a calculated channel matched filter model (page 3, lines 21-35), and estimating the coefficients of the filter using an estimation technique and a known input channel to the equalizer (claim 3).

Moreover, it should be noted that even if novelty of **claim 1** could be argued, based on minor differences between the features of this claim and those disclosed in **D1**, the subject-matter of **claim 1** would not involve an inventive step, Article 33(3) PCT, having regard to the disclosure of **D1**.

3. Dependent claims 2 to 8 do not contain any features which, in combination with the features of claim 1 to which they refer, meet the requirements of the PCT in respect of inventive step (Article 33(3) PCT), since these features appear to be disclosed in D1, D2 or D3, or are common measures.

- claim 2: channel matched filter modelisation, see D2, paragraph II, equations (2), (3) and (4); preselected coefficients are feed forward coefficients of the equaliser

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/01214

filter, see D1; coefficients initialised as complex conjugate of the impulse response coefficients, see D1.

- claim 3: preselected coefficients are feed back filter coefficients, see D1; these coefficients are initialised as autocorrelation values of the channel impulse response coefficients, see D1.

- claim 4: normalising coefficients is a common measure for a skilled person.

- claim 5: LMS, see D2

- claim 6: RLS, see D2

- claim 7: independent training rates for FFF and FBF, see D3, from page 4, line 47 to page 5, line 40.

- claim 8: see D1, page 1593, right-hand column, lines 46-50.

Re Item VII

Certain defects in the international application

1. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.

D2 apparently corresponds to the VTC'98 CONFERENCE cited on page 4, line 10 of the description. However, the date, place and page numbers should have been mentioned.

2. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/01214

Re Item VIII

Certain observations on the international application

1. In claim 3, the values of d_j are not defined for $j = 1, \dots, L$ when the claim depends on claim 1 (Article 6 PCT).
2. In claim 7, some parameters of the equation are not defined (Article 6 PCT).

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference HL57809/001/CIV	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 00/01214	International filing date (day/month/year) 30/03/2000	(Earliest) Priority Date (day/month/year) 30/03/1999
Applicant UNIVERSITY OF BRISTOL		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

- the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
- b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:
- contained in the international application in written form.
 - filed together with the international application in computer readable form.
 - furnished subsequently to this Authority in written form.
 - furnished subsequently to this Authority in computer readable form.
 - the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
 - the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. Certain claims were found unsearchable (See Box I).

3. Unity of Invention is lacking (see Box II).

4. With regard to the title,

- the text is approved as submitted by the applicant.
- the text has been established by this Authority to read as follows:

5. With regard to the abstract,

- the text is approved as submitted by the applicant.
- the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

- as suggested by the applicant.
- because the applicant failed to suggest a figure.
- because this figure better characterizes the invention.

8

None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

P 00 SB 00/01214

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L25/03 H04L7/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 91 17607 A (DANCALL RADIO AS ; CETELCO AS (DK)) 14 November 1991 (1991-11-14) abstract; figure 6 page 3, line 21 - line 35	1
Y	---	2-8

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

6 July 2000

Date of mailing of the international search report

25/07/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Binger, B

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/01214

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KAYA I ET AL: "Exploiting multipath activity using low complexity equalisation techniques for high speed wireless LANs" VTC '98. 48TH IEEE VEHICULAR TECHNOLOGY CONFERENCE. 18-21 MAY 1998, pages 1593-1597 vol.2, XP002141419 1998, New York, NY, USA, IEEE, USA ISBN: 0-7803-4320-4 cited in the application abstract page 1593, column 1, line 45 -page 1594, column 2, line 50 page 1595, column 1, line 30 - line 42 -----	2-6, 8
Y	EP 0 880 253 A (LUCENT TECHNOLOGIES INC) 25 November 1998 (1998-11-25) abstract page 4, line 47 -page 5, line 40 -----	7
A	US 5 732 112 A (LANGBERG EHUD) 24 March 1998 (1998-03-24) abstract column 8, line 59 -column 9, line 30; figure 4 -----	7

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/01214

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9117607	A	14-11-1991	DK 107690 A AT 116773 T AU 7861691 A DE 69106503 D DE 69106503 T EP 0527190 A ES 2066442 T GR 3015683 T	02-11-1991 15-01-1995 27-11-1991 16-02-1995 18-05-1995 17-02-1993 01-03-1995 31-07-1995
EP 0880253	A	25-11-1998	US 6069917 A CA 2233522 A JP 10335982 A	30-05-2000 23-11-1998 18-12-1998
US 5732112	A	24-03-1998	BR 9612296 A CA 2240676 A CN 1209230 A EP 0875095 A JP 11507489 T WO 9724814 A	13-07-1999 10-07-1997 24-02-1999 04-11-1998 29-06-1999 10-07-1997